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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample and a personnel evaluation form are also included. (AG)

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TI 002 040

Development of USTES Aptitude Test Battery for Fourdrinier-Machine Tender

(paper & pulp; wallboard) 539.782

Back Tender, Paper Machine

(paper & pulp) 534.782

U.S. DEPARTMENT OF LABOR
MANPOWER ADMINISTRATION

ED 068559

Technical Report on Development of USTES Aptitude Test Battery

For . . . . .

Fourdrinier-Machine Tender (paper & pulp, wallboard) 539.782
Back Tender, Paper Machine (paper & pulp) 534.782

S-428

(Developed in Cooperation with the
Alabama and Wisconsin State Employment Services)

U. S. DEPARTMENT OF LABOR
Manpower Administration

January 1969

FOREWORD

The United States Training and Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination, predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

GATB Study #2724

Development of USTES Aptitude Test Battery

For

Fourdrinier-Machine Tender (paper and pulp; wallboard) 539.782-018
Back Tender, Paper Machine (paper & pulp) 534.782-014

S-428

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupations of Fourdrinier-Machine Tender (paper & pulp; wallboard) 539.782-018 and Back Tender, Paper Machine (paper & pulp) 534.782-014. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB Scores
N - Numerical Aptitude	80
S - Spatial Aptitude	75
Q - Clerical Perception	95

RESEARCH SUMMARY

Sample:

Eighty-four male workers employed as Fourdrinier-Machine Tenders and Paper Machine Back Tenders in Alabama and Wisconsin.

All individuals in the sample were non-minority group members.

Criterion:

Supervisory ratings

Design:

Concurrent (test and criterion data were collected at approximately the same time).

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, standard deviations, and selective efficiencies.

Concurrent Validity:

Phi Coefficient = .47 (P/2 less than .0005)

Effectiveness of Norms:

Only 67% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the above norms 84% would have been good workers. Thirty-three percent of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms only 16% would have been poor workers. The effectiveness of the norms is shown graphically in Table 1:

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good Workers	67%	84%
Poor Workers	33%	16%

SAMPLE DESCRIPTION

Size:

N = 84

Occupational Status:

Employed workers

Work Setting:

Workers were employed at American Can Company in Green Bay, Wisconsin and Naheola, Alabama.

Employer Selection Requirements:

Education: High School Graduates preferred

Previous Experience: None required

Tests: SRA Adaptability Test

Principal Activities: The job duties for each worker are comparable to those shown in the job description in the Appendix.

Minimum Experience: All workers in the sample had at least six months job experience.

TABLE 2

Means, Standard Deviations, Ranges and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education and Experience

	Mean	SD	Range	r
Age (years)	39.8	8.5	27-62	-.418**
Education (years)	11.0	1.9	6-15	.220*
Experience (months)	76.8	61.2	6-264	-.059

**Significant at the .01 level
*Significant at the .05 level

Experimental Test Battery

All 12 tests of the GATB were administered during February, 1968.

CRITERION

The criterion data consisted of supervisory ratings of job proficiency made at approximately the same time as test data were collected. Ratings and re-rating were made by the immediate supervisor with a two - week interval between ratings.

Rating Scale:

Form SP-21 "Descriptive Rating Scale" was used. This scale (see Appendix) consists of nine items covering different aspects of job performance. Each item has five alternatives corresponding to different degrees of job proficiency.

Reliability:

A reliability coefficient of .94 was obtained between the initial ratings and re-ratings, indicating a significant relationship. The final criterion score consisted of the combined scores of the two ratings.

Criterion Score Distribution:

Possible Range:	18-90
Actual Range:	35-88
Mean:	64.3
Standard Deviation	13.4

Criterion Dichotomy:

The criterion distribution was dichotomized into low and high groups by placing 33% of the sample in the low group to correspond with the percentage of workers considered unsatisfactory or marginal. Workers in the high criterion group were designated as "good workers" and those in the low group as "poor workers". The criterion critical score is 58.

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Tables 3, 4, and 5 show the results of the qualitative and statistical analyses.

TABLE 3

Qualitative Analysis
(Based on the job analysis the aptitudes listed appear to be important to the work performed)

Aptitude	Rationale
G - General Learning Ability	Used in basic knowledge of paper making learning from experience and others, what additives to add or subtract to make quality paper. Must reason through with intelligence and make judgments.
N - Numerical Aptitude	Make quick and accurate changes in pressures, dial indicators, additives, etc. through simple arithmetic.
S - Spatial Aptitude	Must observe a fast moving sheet of newly formed paper stock and visualize if it is being formed properly and make any corrections necessary.
P - Form Perception	Must visually check flow of materials and check gauges, stock and water levels.

TABLE 4

Means, Standard Deviations, Ranges and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N = 84.

Aptitudes	Mean	SD	Range	R
G - General Learning Ability	96.7	15.7	45-133	.532**
V - Verbal Aptitude	92.2	13.1	66-121	.365**
N - Numerical Aptitude	96.2	17.3	30-134	.470**
S - Spatial Aptitude	99.9	18.2	58-147	.406**
P - Form Perception	98.5	19.9	44-140	.385**
Q - Clerical Perception	101.3	12.4	69-129	.392**
K - Motor Coordination	95.7	19.2	56-140	.390**
F - Finger Dexterity	81.6	19.3	15-119	.409**
M - Manual Dexterity	91.3	22.8	23-137	.304**

**Significant at the .01 level

TABLE 5

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X		X	X	X				
Irrelevant									
Relatively High Mean				X	X	X			
Relatively Low Standard Dev.		X				X			
Significant Correlation with Criterion	X	X	X	X	X	X	X	X	X
Aptitudes to be Considered for Trial Norms	G	V	N	S	P	Q	K	F	M

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of the degree to which trial norms consisting of various combinations of Aptitudes G, V, N, S, P, Q, K, F and M at trial cutting scores were able to differentiate between 67% of the sample considered to be good workers and 33% of the sample considered to be poor workers. Trial cutting scores at five-point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three-aptitude norms. For two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about one-third of the sample. For four-aptitude trial norms, cutting scores of slightly less than one standard deviation below the mean will eliminate about one-third of the sample. The Phi Coefficient was used as a basis for comparing trial norms. The optimum differentiation for the occupations of Fourdrinier Machine Tender (paper & pulp; wallboard) 539.782-018 and Back Tender, Paper Machine (paper & pulp) 534.782-014 was provided by the norms of N-80, S-75 and Q-95. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .47 (statistically significant at the .0005 level)

TABLE 6

Concurrent Validity of Trial Norms
N-80, S-75, and Q-95

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	10	46	56
Poor Workers	19	9	28
Total	29	55	84

Phi Coefficient = .47
Significance Level = P/2 less than .0005

Chi Square (X^2y) = 18.5

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study did not meet the requirements for incorporating the occupation studied into any of the 36 OAP's included in Section II of the Manual for the General Aptitude Test Battery. The data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.

DESCRIPTIVE RATING SCALE
(For Aptitude Test Development Studies)

Score____

RATING SCALE FOR _____
D. C. T. Title and Code

Directions: Please read Form SP-20, "Suggestions to Raters", and then fill in the items listed below. In making your ratings, only <u>one</u> box should be checked for each question.

Name of Worker (print) _____
(Last) (First)

Sex: Male_____ Female_____

Company Job Title: _____

How often do you see this worker in a work situation?

☐ See him at work all the time.

☐ See him at work several times a day.

☐ See him at work several times a week.

☐ Seldom see him in work situation.

How long have you worked with him?

☐ Under one month.

☐ One to two months.

☐ Three to five months.

☐ Six months or more.

A. How much work can he get done? (Worker's ability to make efficient use of his time and to work at high speed.)

☐ 1. Capable of very low work output. Can perform only at an unsatisfactory pace.

☐ 2. Capable of low work output. Can perform at a slow pace.

☐ 3. Capable of fair work output. Can perform at an acceptable but not a fast pace.

☐ 4. Capable of high work output. Can perform at a fast pace.

☐ 5. Capable of very high work output. Can perform at an unusually fast pace.

B. How good is the quality of his work? (Worker's ability to do high-grade work which meets quality standards.)

☐ 1. Performance is inferior and almost never meets minimum quality standards.

☐ 2. The grade of his work could stand improvement. Performance is usually acceptable but somewhat inferior in quality.

☐ 3. Performance is acceptable but usually not superior in quality.

☐ 4. Performance is usually superior in quality.

☐ 5. Performance is almost always of the highest quality.

C. How accurate is he in his work? (Worker's ability to avoid making mistakes.)

☐ 1. Makes very many mistakes. Work needs constant checking.

☐ 2. Makes frequent mistakes. Work needs more checking than is desirable.

☐ 3. Makes mistakes occasionally. Work needs only normal checking.

☐ 4. Makes few mistakes. Work seldom needs checking.

☐ 5. Rarely makes a mistake. Work almost never needs checking.

D. How much does he know about his job? (Worker's understanding of the principles, equipment, materials and methods that have to do directly or indirectly with his work.)

☐ 1. Has very limited knowledge. Does not know enough to do his job adequately.

☐ 2. Has little knowledge. Knows enough to "get by."

☐ 3. Has moderate amount of knowledge. Knows enough to do fair work.

☐ 4. Has broad knowledge. Knows enough to do good work.

☐ 5. Has complete knowledge. Knows his job thoroughly.

E. How much aptitude or facility does he have for this kind of work? (Worker's adeptness or knack for performing his job easily and well.)

☐ 1. Has great difficulty doing his job. Not at all suited to this kind of work.

☐ 2. Usually has some difficulty doing his job. Not too well suited to this kind of work.

☐ 3. Does his job without too much difficulty. Fairly well suited to this kind of work.

☐ 4. Usually does his job without difficulty. Well suited to this kind of work.

☐ 5. Does his job with great ease. Exceptionally well suited for this kind of work.

F. How large a variety of job duties can he perform efficiently? (Worker's ability to handle several different operations in his work.)

☐ 1. Cannot perform different operations adequately.

☐ 2. Can perform a limited number of different operations efficiently.

☐ 3. Can perform several different operations with reasonable efficiency.

☐ 4. Can perform many different operations efficiently.

☐ 5. Can perform an unusually large variety of different operations efficiently.

G. How resourceful is he when something different comes up or something out of the ordinary occurs? (Worker's ability to apply what he already knows to a new situation.)

☐ 1. Almost never is able to figure out what to do. Needs help on even minor problems.

☐ 2. Often has difficulty handling new situations. Needs help on all but simple problems.

☐ 3. Sometimes knows what to do, sometimes doesn't. Can deal with problems that are not too complex.

☐ 4. Usually able to handle new situations. Needs help on only complex problems.

☐ 5. Practically always figures out what to do himself. Rarely needs help, even on complex problems.

H. How many practical suggestions does he make for doing things in better ways? (Worker's ability to improve work methods.)

☐ 1. Sticks strictly with the routine. Contributes nothing in the way of practical suggestions.

☐ 2. Slow to see new ways to improve methods. Contributes few practical suggestions.

☐ 3. Neither quick nor slow to see new ways to improve methods. Contributes some practical suggestions.

☐ 4. Quick to see new ways to improve methods. Contributes more than his share of practical suggestions.

☐ 5. Extremely alert to see new ways to improve methods. Contributes an unusually large number of practical suggestions.

I. Considering all the factors already rated, and only these factors, how acceptable is his work? (Worker's "all-around" ability to do his job.)

☐ 1. Would be better off without him. Performance usually not acceptable.

☐ 2. Of limited value to the organization. Performance somewhat inferior.

☐ 3. A fairly proficient worker. Performance generally acceptable.

☐ 4. A valuable worker. Performance usually superior.

☐ 5. An unusually competent worker. Performance almost always top notch.

FACT SHEET

Job Title: Fourdrinier-Machine Tender (paper & pulp) 539.782-018

Job Summary: Operates a Beloit-Fourdrinier Wet End Machine to make paper board or paper toweling to specified thickness, width and strength from Paper Stock.

Work Performed: Work Preparation: Takes over from outgoing tender by checking specifications for grade and quality of paper being made. Checks speed of machine and weight of paper being made. Checks any machine trouble or breakdown and cause of breakdown.

Tends Machine: Checks control-instrument panel and individual gauges to regulate vacuums, refining equipment, freeness or drainage of pulp onto wire screen, air pressure, steam pressure, water usage, cleaners and pumps. Checks Trim Squirts to see if edges of Wet Sheet are being cut smoothly and evenly. Visually checks flow of stock and speed of wire screen to determine if both are traveling at the same speed and no wave or ruffle appears on the sheet. Makes adjustments of boxes and adjusts water for proper stock consistency. Observes wire tension, wire pit temperature, level of water in pit, actual level of stock in Headbox and makes adjustments if needed by regulating air pressure, steam pressure and water valves. Interprets laboratory report of paper test each hour and makes necessary change in flow rate of additives, speed of machine, flow of stock onto wire and water removal to change moisture content, caliper, mullen, weight and ply bond. Makes paper grade change when orders are received from supervisor. Uses addition, subtraction, division in pre-developed formulas to determine speed of machine. Regulates flow of water and stock.

Wire and Felt Maintenance: Occasionally stops machine to repair or install new wire or for felt changes; notifies beater room operator to shut down flow of pulp to headbox, picks up Dandy Screen by hand to eliminate friction; stops pumps and other moving equipment. Repairs wire by electronic fusing or sews with thin copper wire by hand, occasionally repairs felts with needle and special wool thread.

Keeps Operating Data Sheet: Every two hours checks all gauges and pertinent information on amperes, press load, vacuums, water percentage, stock flow and records on data sheet.

Paper Board Break Restart: Cleans Deckle Board, trims squirts (edge), Dandy Roll showers by fingering and using edge of hand. Washes down press felt section, couch pit and cat walk with water hose. Removes any foreign material or pulp build-up found that would impede or damage flow of sheet. Starts sheet back in press rollers by holding board under sheet and letting wet sheet flow over board until it enters between rollers and is pulled through and forward by them. Checks couch roll vacuum and makes adjustments for correct draw.

Job Title: Back Tender, Paper Machine (paper & pulp) 534.782

Job Summary: Operates drier, calender, and winding sections of Fourdrinier or cylinder-type paper making machines to produce paper and wind it onto rolls.

Work Performed: Work Preparation: Takes over from outgoing back tender by checking speed of machine and weight of paper being made. Checks number of rolls running in Calender Stack and checks machine log for machine trouble.

Machine Tending: Visually checks gauges and dial indicators for steam pressure on driers; drier drainage system; pumps; Size Press Load and tension on paper and belts. Adjusts stacks with crescent wrench and other small hand tools when needed, to keep proper alignment or uniformity of paper from discharge end of machine onto rolls of winding machine.

Adjusts, when needed, the roller type knives that cut the paper as it is being wound onto smaller rolls.

Visually inspects for any steam leaks in drier. Inspects paper for brightness, dryness, imperfections and cleanliness. Inspects Rope Run to determine if paper is being guided correctly through machine. Checks for oil leaks and tightness and alignment of paper onto roll.

Notifies the Tender verbally or by hand signal of any change that may be needed to improve the quality of the paper. May adjust press rolls to change thickness of paper.

Keeps Log: Records each hour, the steam pressure in each section of the drier top and bottom; the time of day each lab report is received and the number of the reel being rolled; all lost time and why, and the size press roll.

Interprets Laboratory Report: Receives every two hours a report from the laboratory giving information as to moisture content, caliper, mullen and weight of paper. Discussess results with Tender and makes necessary control changes to improve quality of paper.

Effectiveness of Norms

Only 67% of the non-test selected workers used for this study were good workers; if the workers had been test-selected with the S-428 Norms, 84% would have been good workers. 33% of the non-test selected workers used for this study were poor workers; if the workers had been test-selected with S-428 Norms, only 16% would have been poor workers.

Applicability of S-428 Norms

The aptitude test battery is applicable to jobs which include a majority of the duties described below.

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